

REMARKS

Entry of this Amendment and supplement to the Amendment filed on April 19, 2004 is respectfully requested.

By the present Amendment, new claims 34-46 are presented for examination to supplement the presently pending claims. Regarding this, it is noted that these claims 34-46 correspond to the pending claims 1-4, 7-11 and 30-33, but define additional features of the present invention to further define over the cited prior art, including the references to Hartner and Okudaira relied in the December 18, 2003 Office Action. As such, these new claims 34-46 contain all of the limitations of the pending claims 1-4, 7-11 and 30-33, plus the additional distinctions discussed below.

In the first place, each of the independent claims 34, 38, 43 and 45 includes the limitation that the opening portion has a wider area at an upper portion thereof and a narrow area at a lower portion thereof. Correspondingly, the conductive film formed in the opening portion is defined as a tapered conductive film:

“to have a wider area at a surface adjacent the upper portion of the opening portion and a narrow area adjacent the lower portion of the opening portion.”

This can clearly be seen, for example, in the conductive plugs 42 shown in Fig. 1.

In addition, each of the independent claims 34, 38, 43 and 45 includes an additional limitation that a distance from a first electrode edge to a diffusion barrier edge is larger than a width of a word line coupled to the transistor. Referring again to Fig. 1, it can be seen that the word line is represented by the numeral 24, coupled to the claimed transistors. Correspondingly, the first electrode corresponds to the

lower electrode 61 shown in Fig. 1 while the diffusion barrier film is represented by the numeral 51.

Reconsideration and allowance of these newly presented claims 34-46 over the references to Hartner and Okudaira is respectfully requested. With regard to this, it is quite clear that the conductive plugs shown in the figures of Hartner and Okudaira are both of a perpendicular shape. Thus, these references completely fail to teach or suggest the tapered conductive film arrangement now defined by the newly presented claims. It is noted that the advantage of this tapered structure is that the contact area between the lower electrode and the plug (e.g. the lower electrode 61 and the conductor plug 42 of Fig. 1, for example) is larger than the contact area between the diffusion layer of the transistor and the plug. This also serves to reduce the contact resistance between the lower electrode and the plug as well as securing the dimensional margin (that is, the margin between the plug and the diffusion layer of the transistor). The result of this is preventing a rapid increase in contact resistance that could otherwise occur if a slight oxidation of the diffusion barrier layer occurred. Inasmuch as the cited references to Hartner and Okudaira completely fail to recognize this feature, or these advantages, regarding the tapered conductor plug, reconsideration and allowance of the newly presented claims is respectfully requested.

In addition, the references to Hartner and Okudaira fail to recognize the dimensional margin between the lower electrode and the diffusion barrier defined by the present claims relative to the width of the word line. In Okudaira's Fig. 1, the dimensional margin between the lower electrode 14 and the diffusion barrier film 13 is essentially zero, and, as such, it is clear that the structure is small in comparison

with the word line for C. This is quite different from the present invention in which the dimensional margin between the lower electrode 61 and the diffusion barrier 51 is large in comparison with the width of the word line 24, as clearly shown in Fig. 1 of the invention. This serves to make the distance substantial between the end of the lower electrode to the diffusion barrier layer. As such, the diffusion length of oxygen through the reaction barrier film becomes greater. Therefor, the likelihood of oxidizing the TiN is reduced.

This feature is also completely lacking from both Hartner and Okudaira. In Hartner, diffusion of oxide can be prevented by SiN, so there is no need to consider a plug shape to provide a ling distance between the end of the lower electrode and the diffusion barrier layer. Similarly, Okudaira provides no suggestion for this feature. Accordingly, in addition to the features discussed above concerning the tapered conductive plug, as well as the other features of the present invention discussed in the Amendment filed April 19, 2004, reconsideration and allowance of claims 34-46 based on the recitations concerning the relationship between the distance between the first electrode edge to the diffusion barrier edge being larger than the width of the word line is also respectfully requested.

If the Examiner believes that there are any other points which may be clarified or otherwise disposed of either by telephone discussion or by personal interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of

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this paper, including extension of time fees, to the Deposit Account No. 01-2135 (Docket No. 520.37546X00), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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